WINGWALL DESIGN LENGTH

The design length of the wingwall shall be from the back face of the abutment and shall end approximately 4 feet beyond the point of intersection of the embankment slope with the finished roadway grade.

WINGWALL FOUNDATION SUPPORT

Normally, a wingwall will be cantilevered off of the abutment with no special foundation support needed for the wingwall.

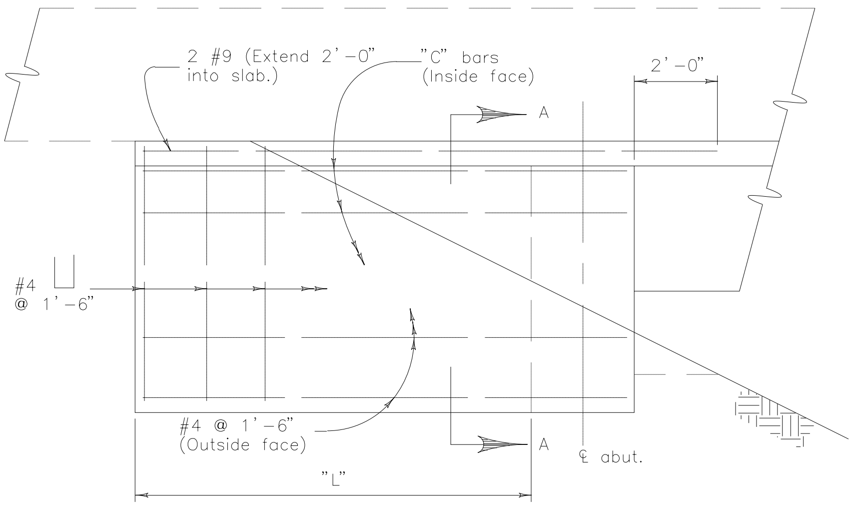
When the required wingwall length exceeds the length for a practical wing cantilevered off the abutment, a retaining wall shall be used along with a nominal length of cantilevered wing to provide the needed wingwall length. The foundation support shall be the same as that of the abutment. This is to reduce the risk of the retaining wall settling, subsequent misalignment, and leaking, and broken joints that are unmaintainable.

WINGWALL DESIGN LOADS

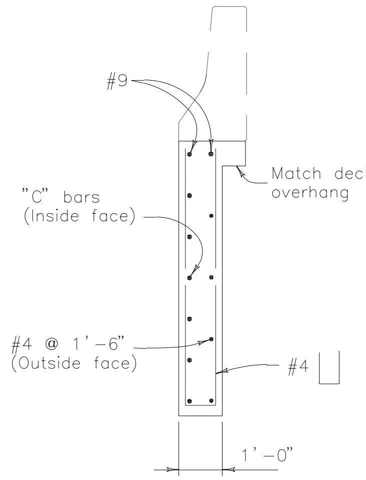
The design shall be based on an equivalent fluid pressure of 36 pounds per cubic foot and a live load surcharge of 2 feet of earth. The equivalent fluid pressure and live load surcharge shall be applied to the full depth of the wingwall at the back face of the abutment and to a depth 3 feet below the elevation of the embankment at the outside of the end of the wing. This pattern of loading shall be used only for wingwalls cantilevered off the abutment. Retaining walls shall be fully loaded as required for their design height.

The design of wings cantilevered off the abutment also shall provide for a 16 kip wheel load with impact located 1’-0" from the end of the wingwall. Under this vertical loading condition, a 50 per cent overstress is allowed in combination with other forces.

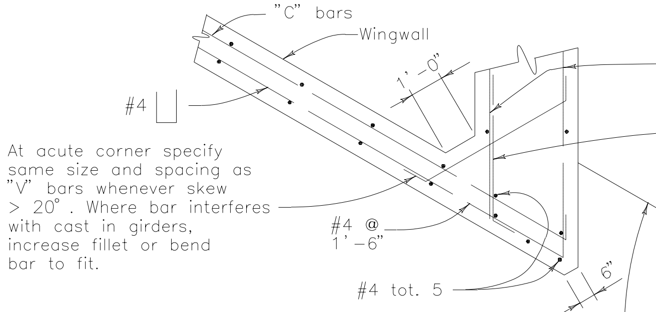
The design of wingwalls also shall provide for the 10 kip horizontal force applied to the bridge railing and distributed according to AASHTO. Under this horizontal loading condition, no other loads, including earth pressure, need be considered.

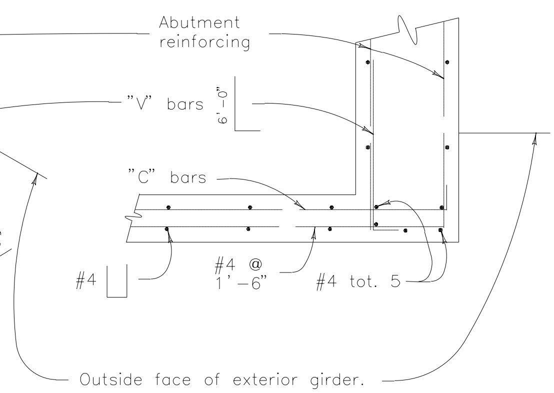


ELEVATION



SECTION A-A



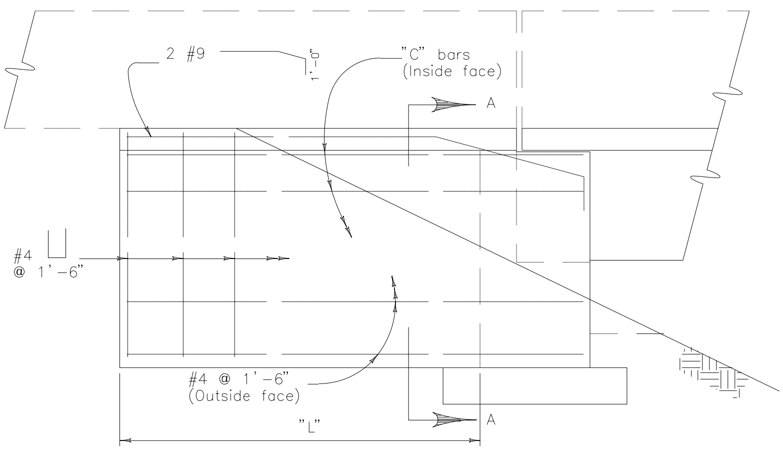


ACUTE CORNER DETAIL

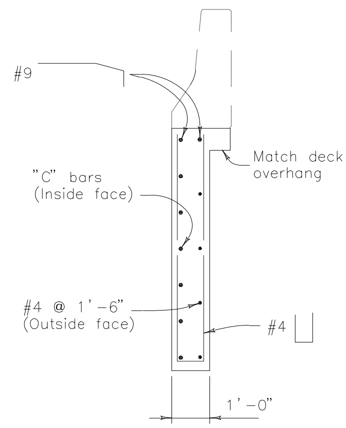
CORNER DETAIL

"L"	"C" bars	"V" bars
10'	#5 @ 1'-0"	#4 @ 1'-6"
12'	#5 @ 9"	#4 @ 1'-6"
14'	#6 @ 9"	#4 @ 1'-6"
16'	#7 @ 9"	#5 @ 1'-6"

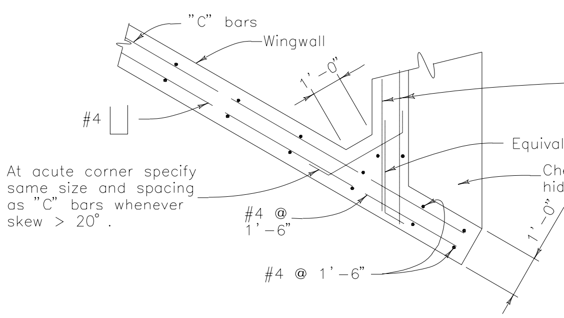
"L" may be exceeded by 1'-0" before using next longer length. Reinforcment based on 2'-6" wide abutment and 1'-0" wingwall.

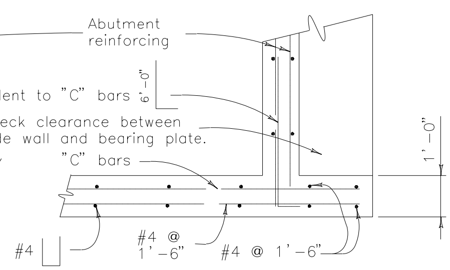


ELEVATION



SECTION A–A





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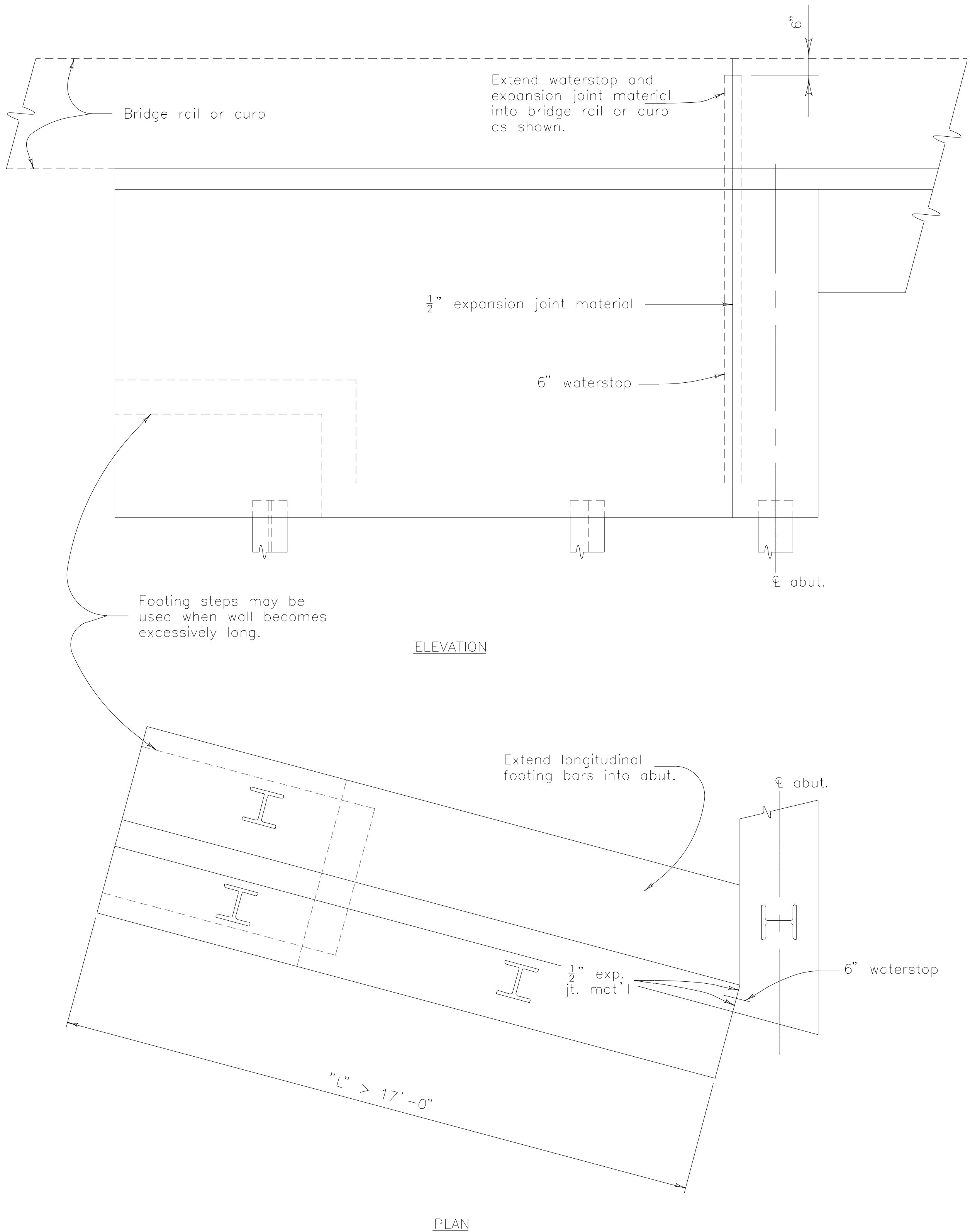

6"
Bridge rail or curb
Extend waterstop and
expansion joint material
into bridge rail or curb
as shown.
½" expansion joint material
6" waterstop
℄ abut.
Footing steps may be
used when wall becomes
excessively long.
ELEVATION
Extend longitudinal
footing bars into abut.
℄ abut.
½" exp.
jt. mat'l
6" waterstop
"L" > 17'-0"
PLAN

There are many on system bridges that were designed and built with integral, end diaphragm type abutments on a single row of piles. Although these bridges were built without expansion devices or bearings, they continue to perform satisfactorily. The primary objective of this type of abutment is to eliminate or reduce joints in bridge superstructures. Secondarily it can simplify design, detailing, and construction. The integral abutment eliminates bearings and reduces foundation requirements by removing overturning moments from the foundation design.

Integral, end diaphragm type, abutments without expansion devices or bearings shall be used where continuous structure lengths are less than the following. These lengths are based on the center of motion located at the middle of the bridge, and a temperature range of motion of 50 mm (2 in.). The temperature range assumed is 45 degree C (80 degree F) for concrete decked steel structures and 40 degree C (70 degree F) for concrete structures, as per the *AASHTO Guide Specifications for Thermal Effects in Concrete Bridge Superstructures:*

TYPE OF GIRDER	MAXIMUM STRUCTURE LENGTH
Steel	195 M (640 Ft.)
Cast place or Precast Concrete	240 M (790 Ft.)

Pretensioned or post-tensioned concrete should have a provision for creep, shrinkage, and elastic shortening, if this shortening plus temperature fall motion exceeds 25 mm (1 in.). Temporary sliding elements between the upper and lower abutment may be used, or details that increase the flexibility of the foundation as discussed below. Steps must also be taken to ensure the movement capability at the end of the approach slab is not exceeded.

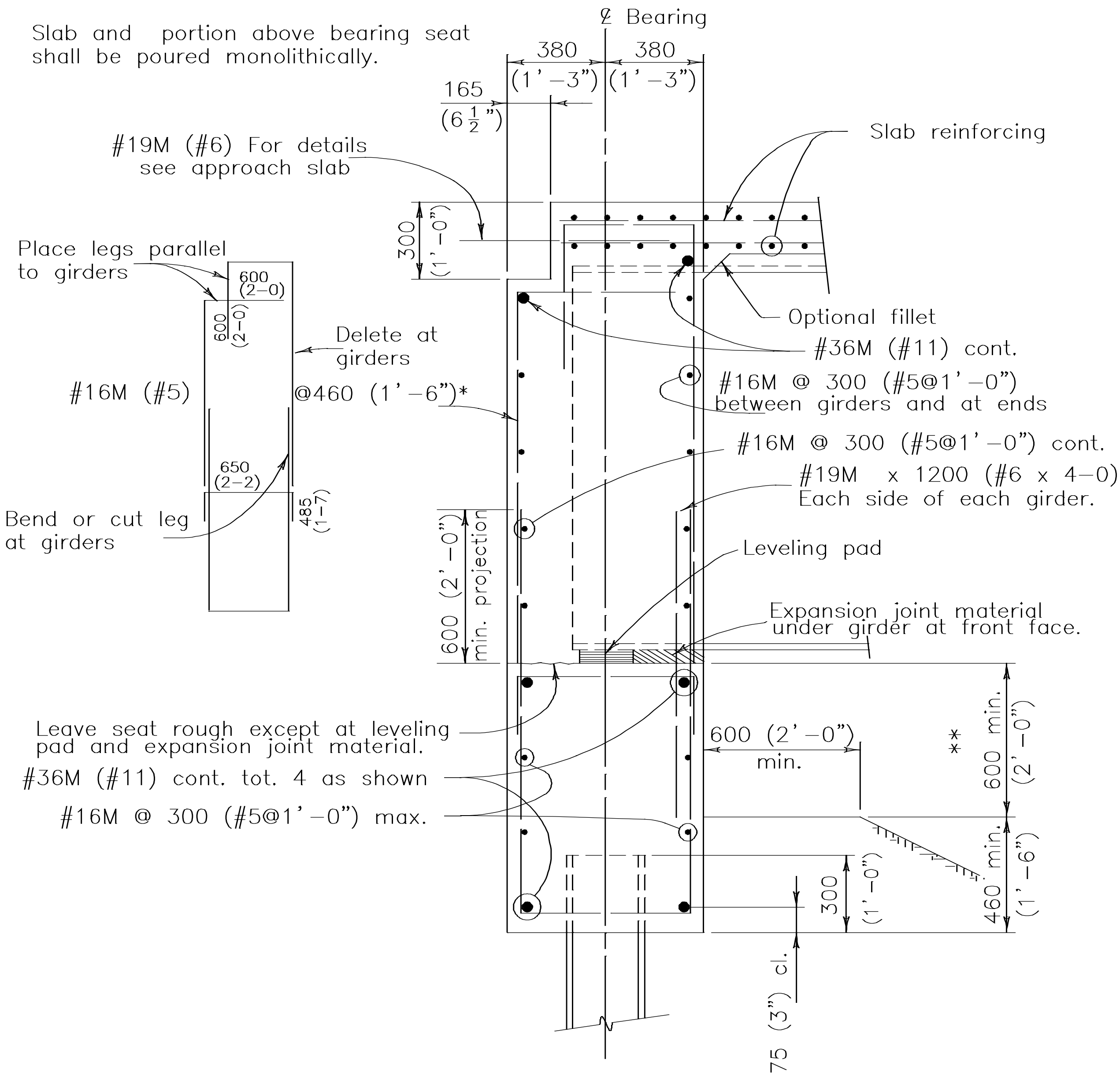
Greater lengths may be used if analysis shows that abutment, foundation, and superstructure design limits are not exceeded, and motion at the end of approach slab is within the capabilities there. The calculations backing up the decision shall be included with the design notes for the structure.

In some cases, site conditions and/or design restraints may not allow the use of this type of abutment, but oversized holes drilled for the piling and filled with sand or a cohesive mud (which flows under long term creep shortening) may be used to compensate for a lack of pile flexibility. If caissons or spread foundations are used in lieu of the piles shown on the next page, sliding sheet metal with elastomeric pads may be used on top of caissons or spread foundations when a pinned connection does not provide enough flexibility.

Integral abutments may be placed on shallow or deep foundations behind retaining walls of all types. Integral diaphragms have been founded on old retaining wall stems or old abutment seats as well. Several structures with tall integral abutments have been built with a gap between the abutment and reinforced fill to reduce earth pressures. This could be used to extend the locked up length capability as well. However, it may be impractical to extend the thermal motion capabilities substantially as the joint at the end of the approach slab has a limited capability and this is not a maintainable location for a modular device.

Poorly balanced earth pressures due to severe skews (less than 56 degrees between abutment axis and the allowed direction of motion) may be dealt with by battering piles perpendicular to the planned allowed motion to resist the unbalanced earth pressures.

Standard integral, end diaphragm type, abutment on piling details are shown on the following page.



TYPICAL ABUTMENT SECTION

Note: All abutment and wingwall concrete shall be Class D (Bridge)

Extend strands from the bottom of precast sections into abutment, anchor the bottom of steel sections to abutment with studs, bearing stiffeners, anchor bolts, or diaphragm gussets.

* 300 (1'-0") if structure length longer than 90M (300') or ** greater than 1050 (3'-6").

USE OF APPROACH SLAB

Approach slabs are used to alleviate problems with settlement of the bridge approaches relative to the bridge deck. The main causes of this settlement are movement of the abutment, settlement and live load compaction of the backfill, moisture, and erosion.

Approach slabs shall be used under the following conditions:

1. Overall structure length greater than 250 feet.
2. Adjacent roadway is concrete.
3. Where high fills may result in approach settlement.
4. When the District requests them.
5. All post-tensioned structures.

In all cases, the approach slab shall be anchored to the abutment. When the adjacent roadway is concrete, an expansion device shall be required between the end of roadway and the end of approach slab.

Approach slab notches shall be provided on all abutments, regardless of whether or not an approach slab will be placed with the original construction.

For details of an approach slab notch, see *Subsection 7.2.*